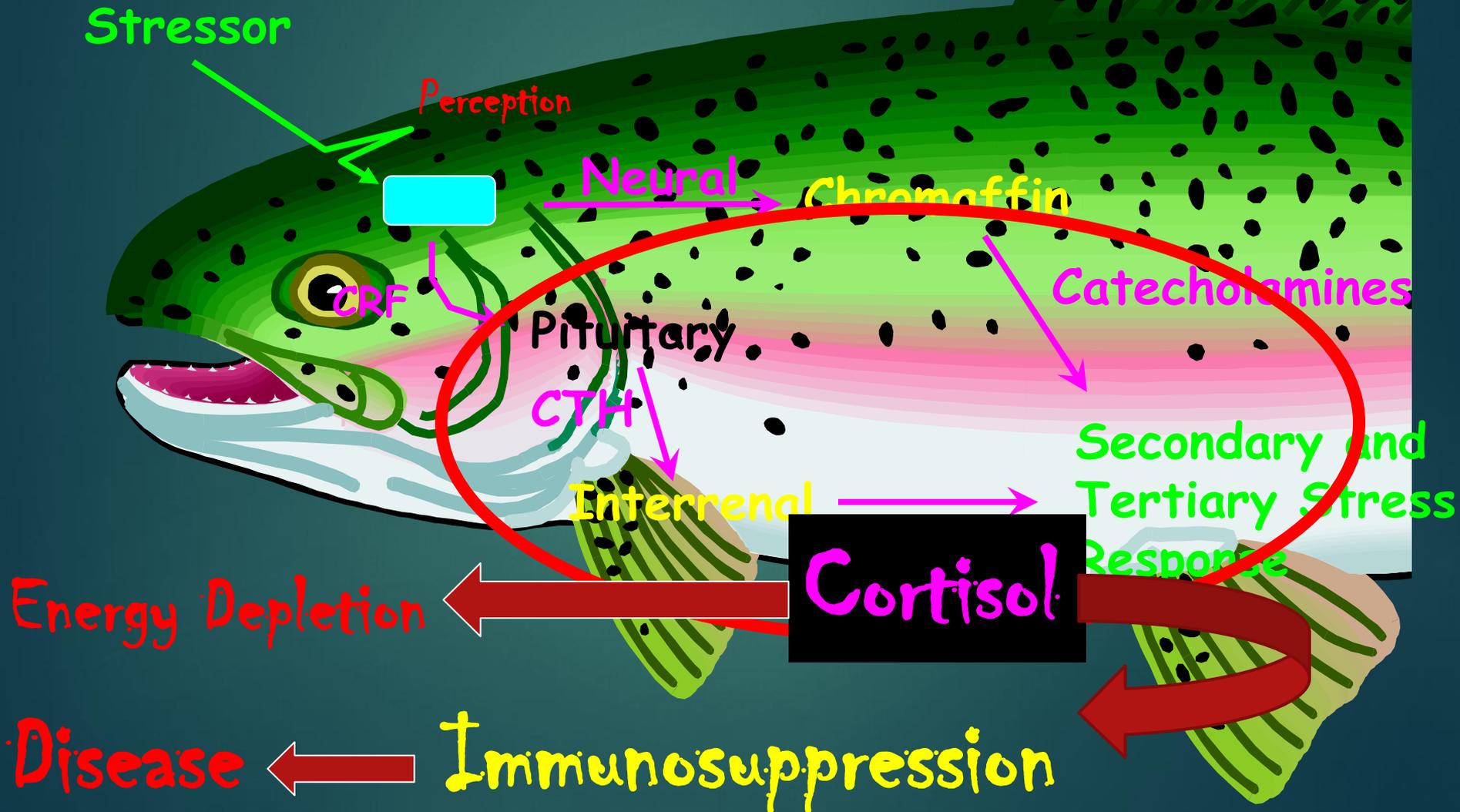


Prespawning Mortality of Middle Fork Willamette Chinook Salmon: improving trap, transport and release operations

**JIM PETERSON, CAM SHARPE, CARL SCHRECK,
TY DEWEBER, MIKE KENT**

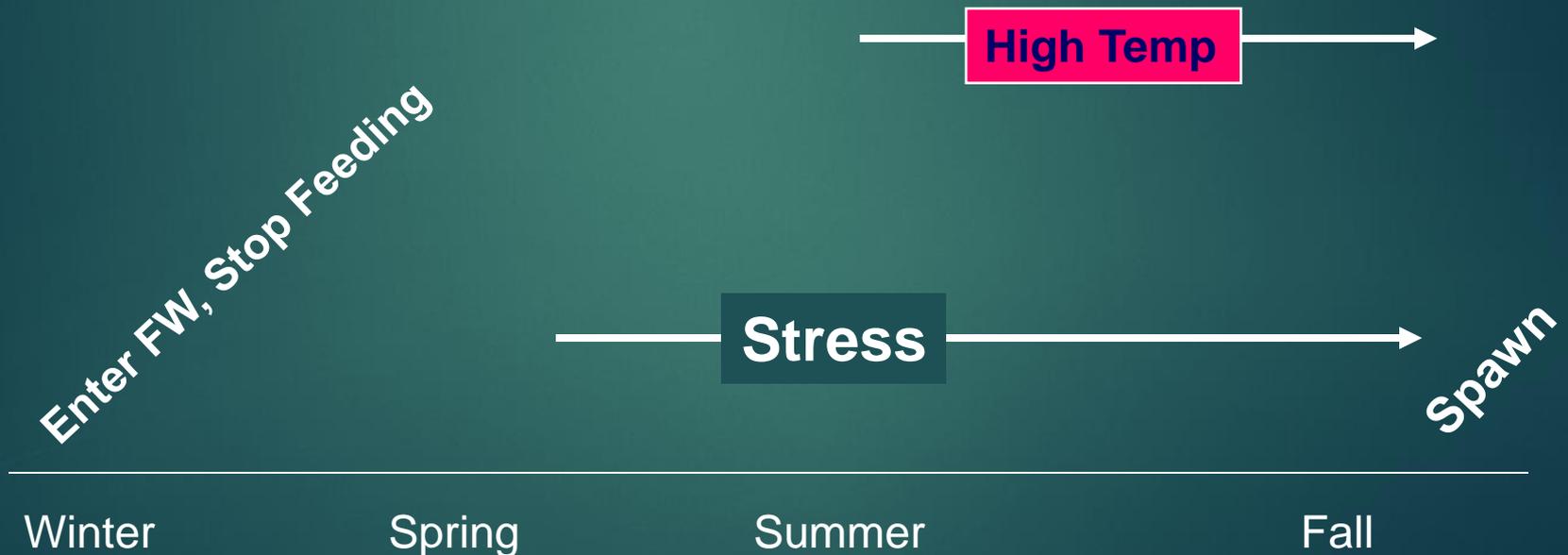
Why salmon die after spawning

Cushing's Syndrome

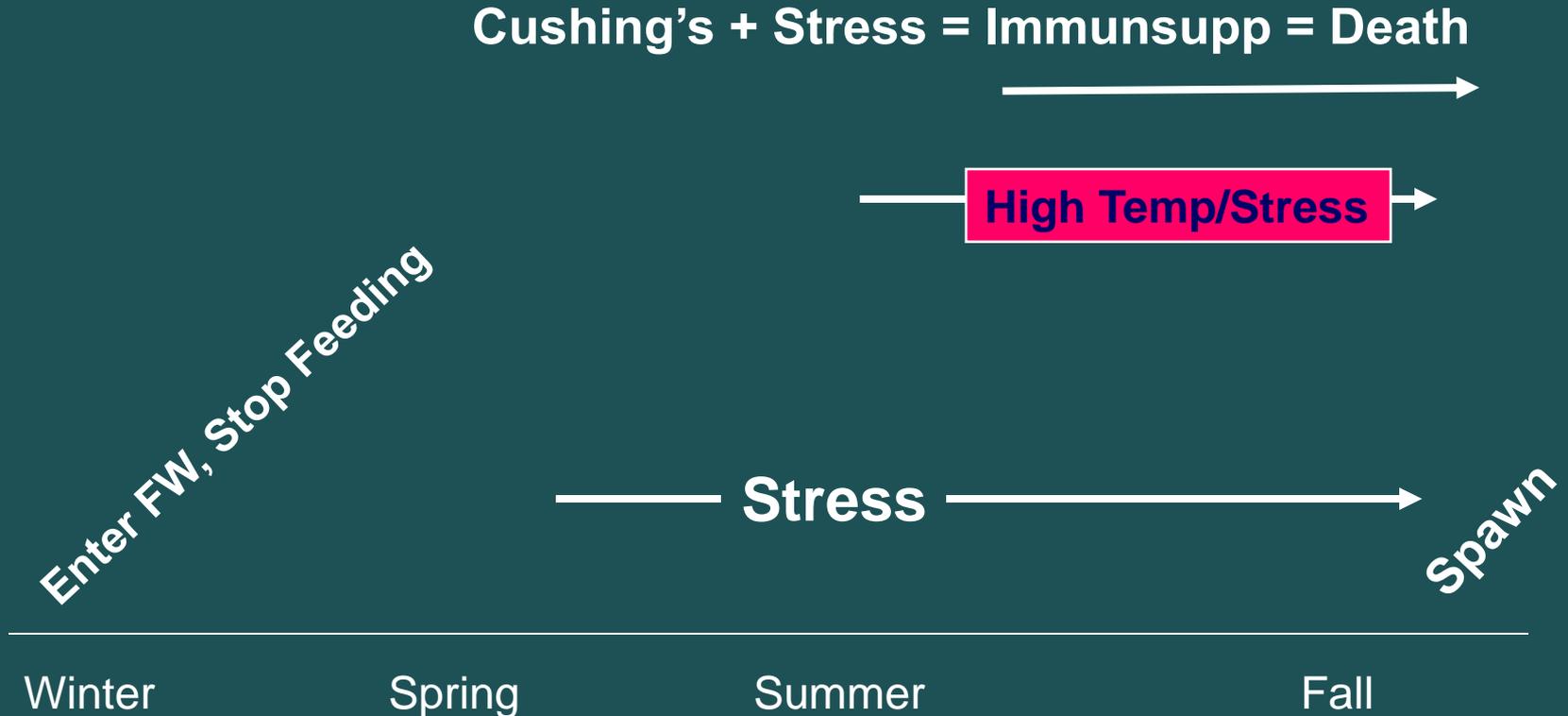


Why do salmon die early?

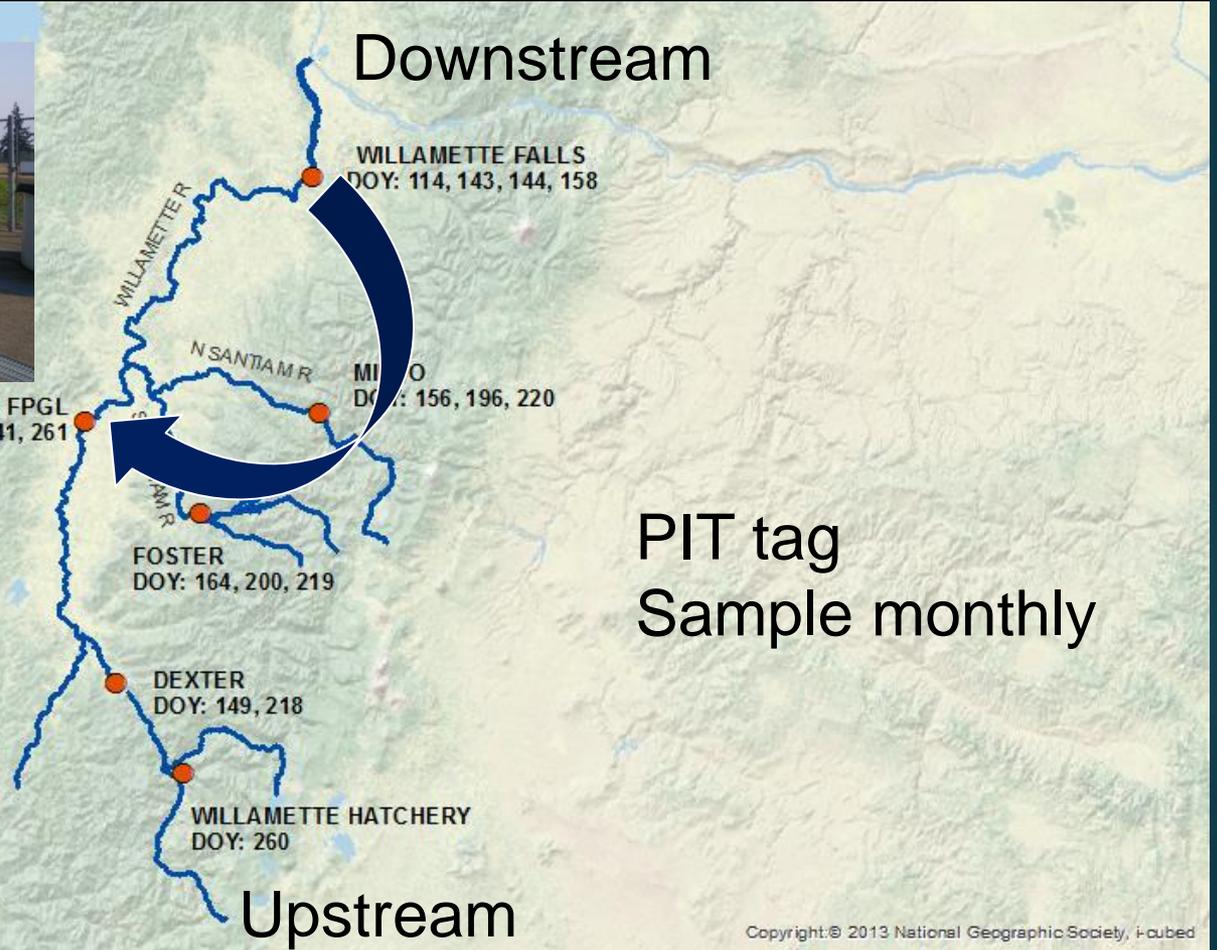
Sequence of Events in Adult Spring Chinook

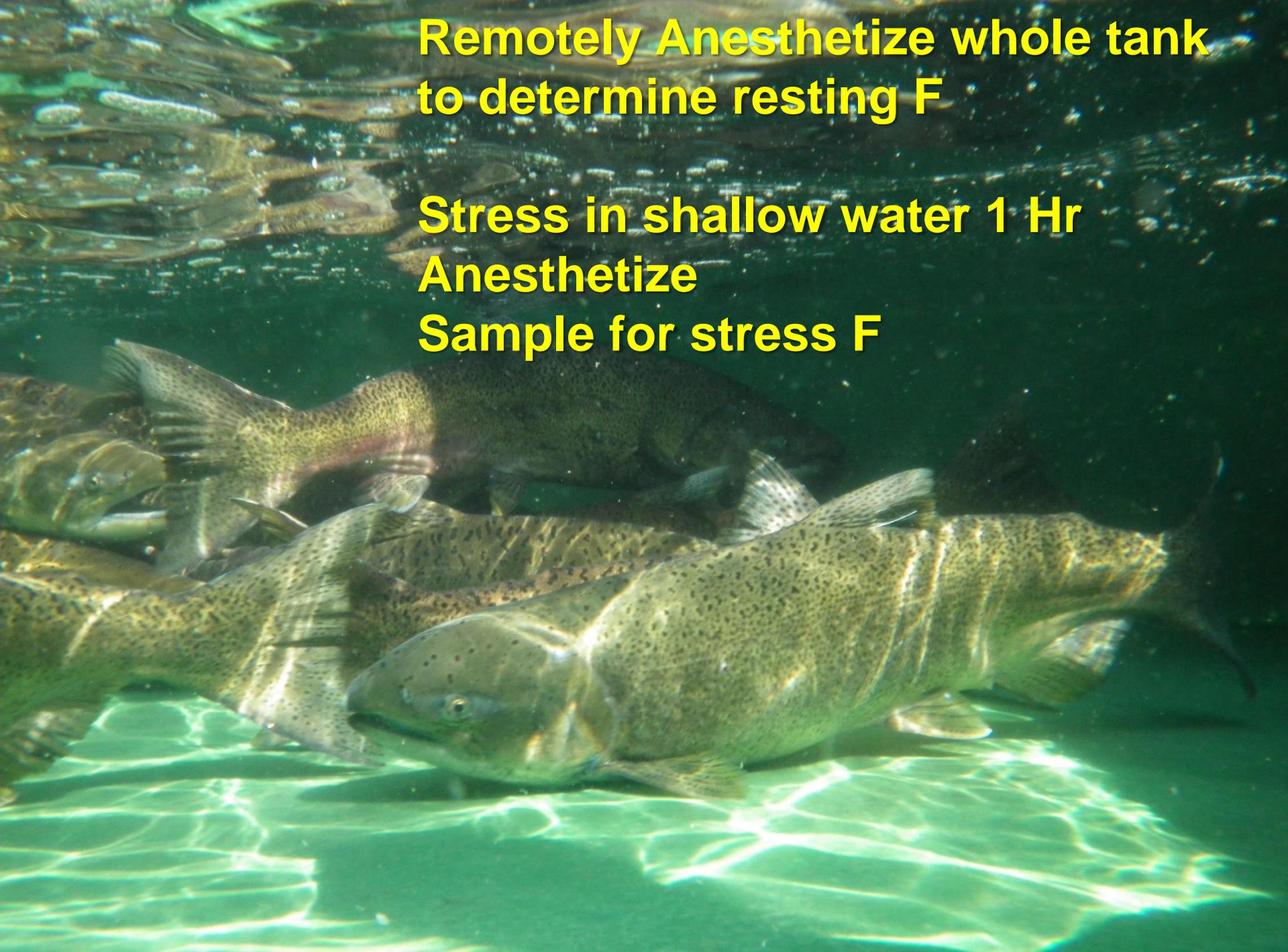


Effects of stress + Cushing's syndrome



Determine if cortisol stress response maintained whilst Cushingoid

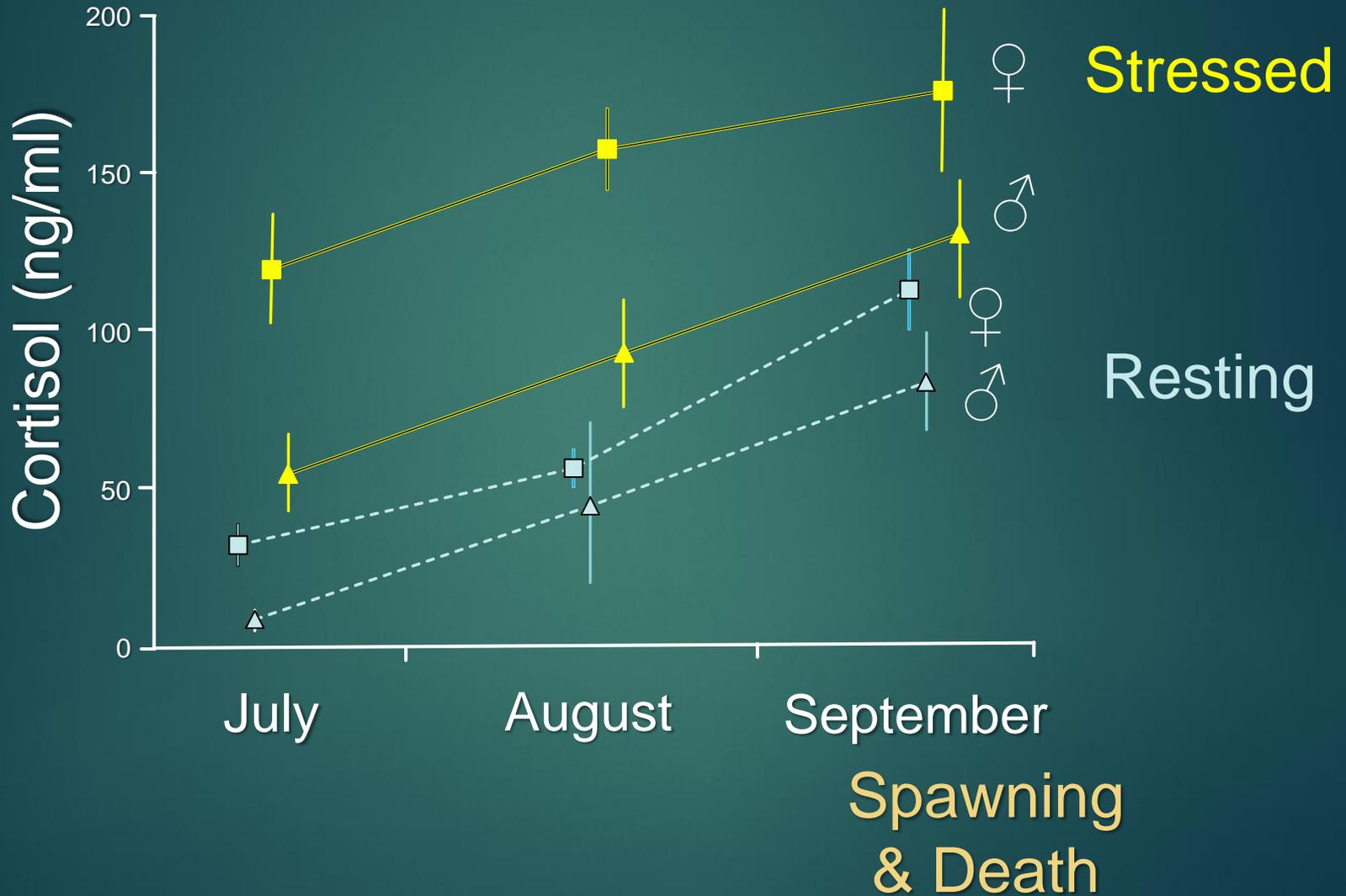


An underwater photograph of several salmon in a tank. The fish are swimming in clear, shallow water. Sunlight filters through the water, creating bright, shimmering patterns on the bottom. The fish have a silvery-green color with dark spots. The text is overlaid in the upper right quadrant.

**Remotely Anesthetize whole tank
to determine resting F**

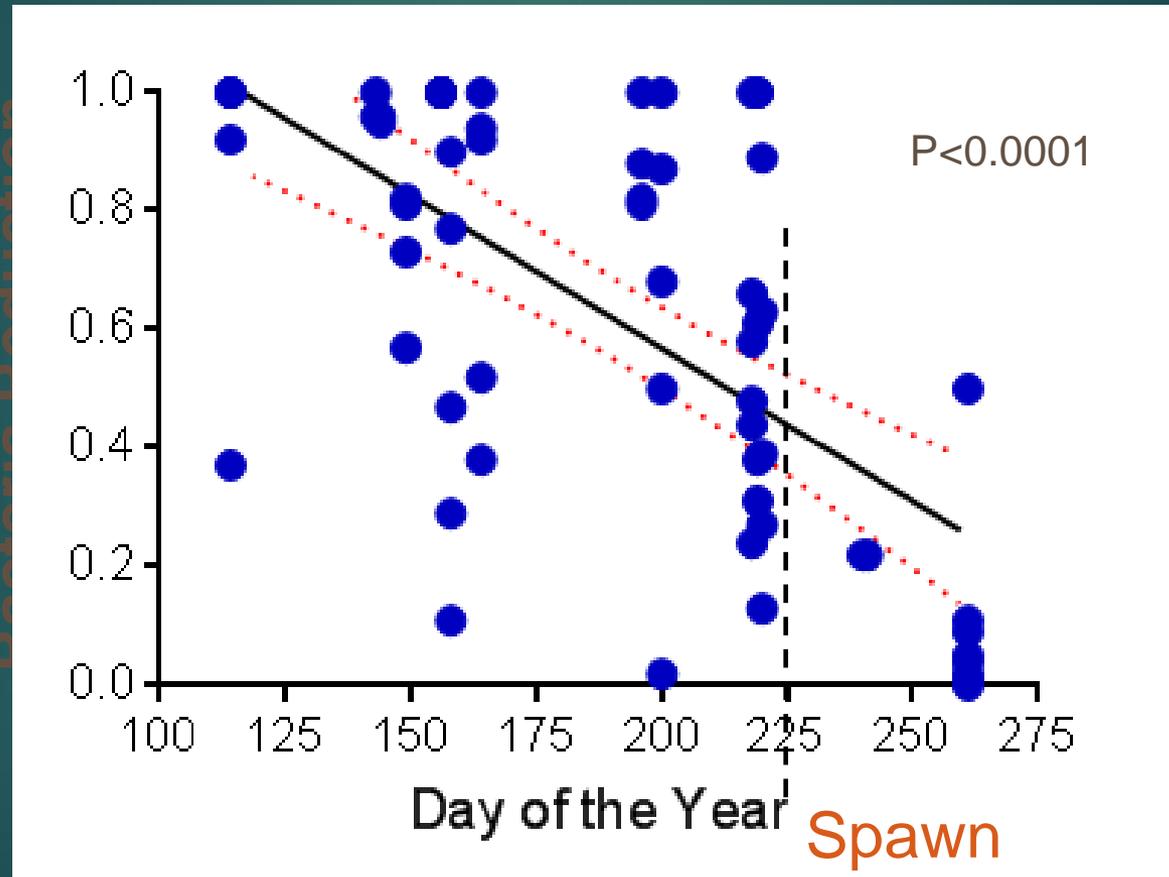
**Stress in shallow water 1 Hr
Anesthetize
Sample for stress F**

Experimental Evidence of Stress Response



Innate Immune Response

Plasma Diluted 1:25



Importance

Double whammy of increased resting stress hormone and increased response to stressor.

More stress earlier means:

1. More rapid energy drain
2. Less ability to resist pathogens
3. Enhanced probability of PSM

Spawning Success Related to:

1. % PSM

2. Importance of sublethal effects on gamete quality

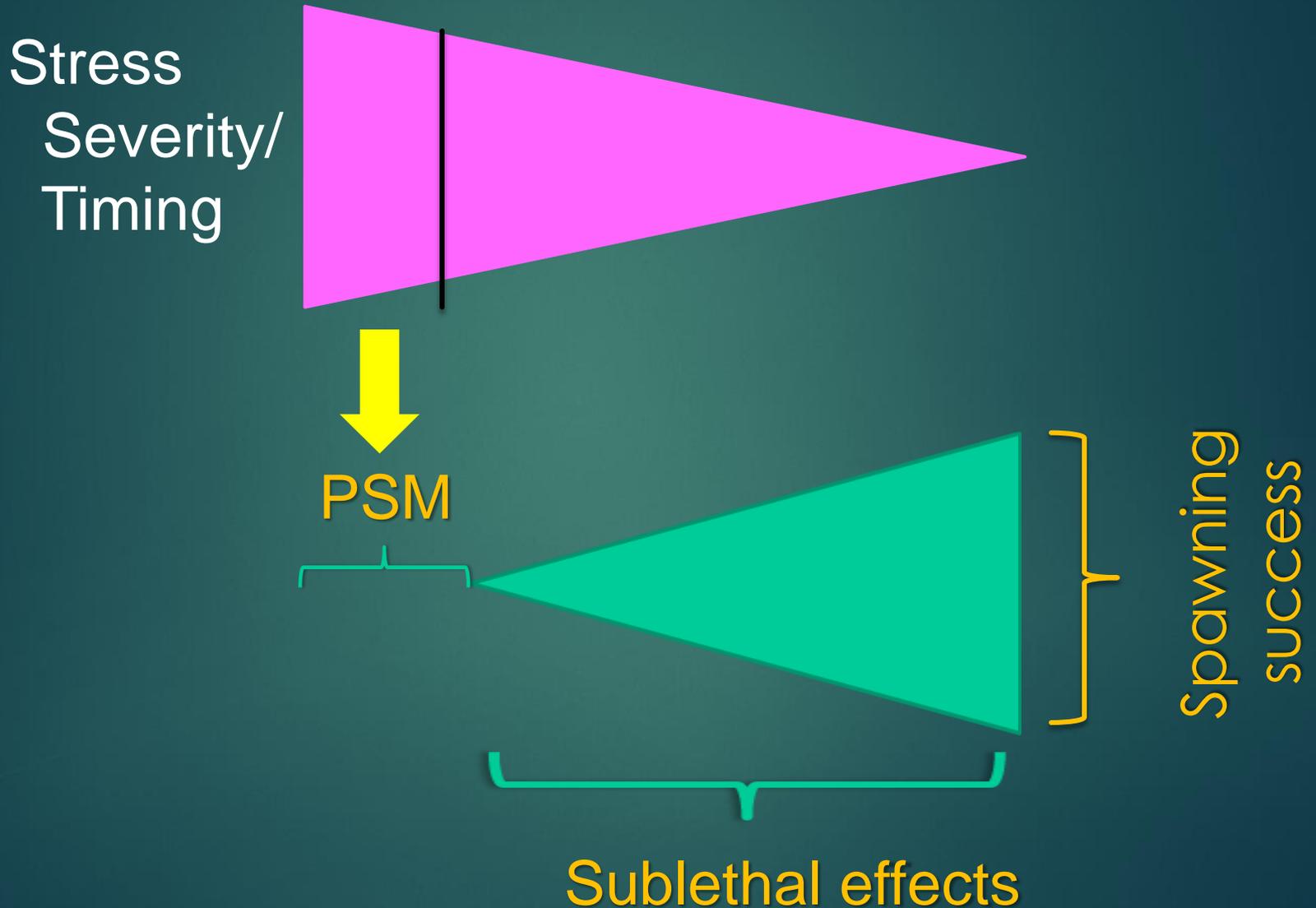
a. Reduced fecundity

b. Reduced embryo success

Some known about #1,

..... little to nothing about # 2

Stress/Spawn Success Relationship



Factors related to PSM (statistical relationships)

Transport mortality (Colvin et al.)

Loading, transport time

Willamette discharge (average)

Degree day accumulation (average)

Truck (batch)

Trip of the day

Outplant mortality (Deweber et al.)

Outplant site

Week of year

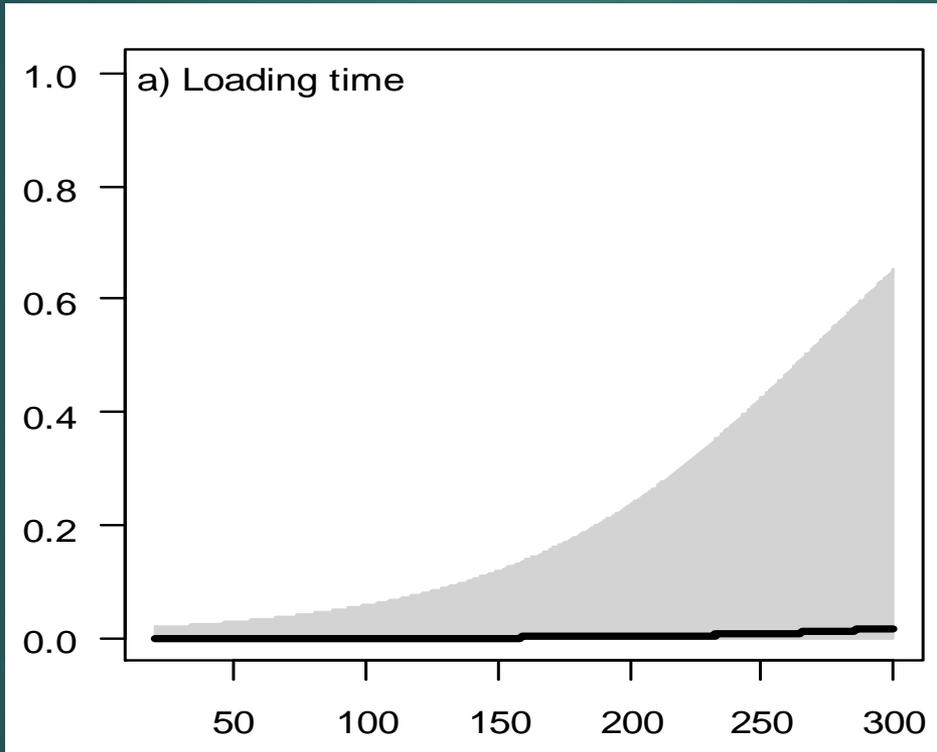
Truck (batch)

Year

Problem: factors confounded, learning unplanned, much uncertainty

Uncertainty and transport mortality

Predicted probability of mortality

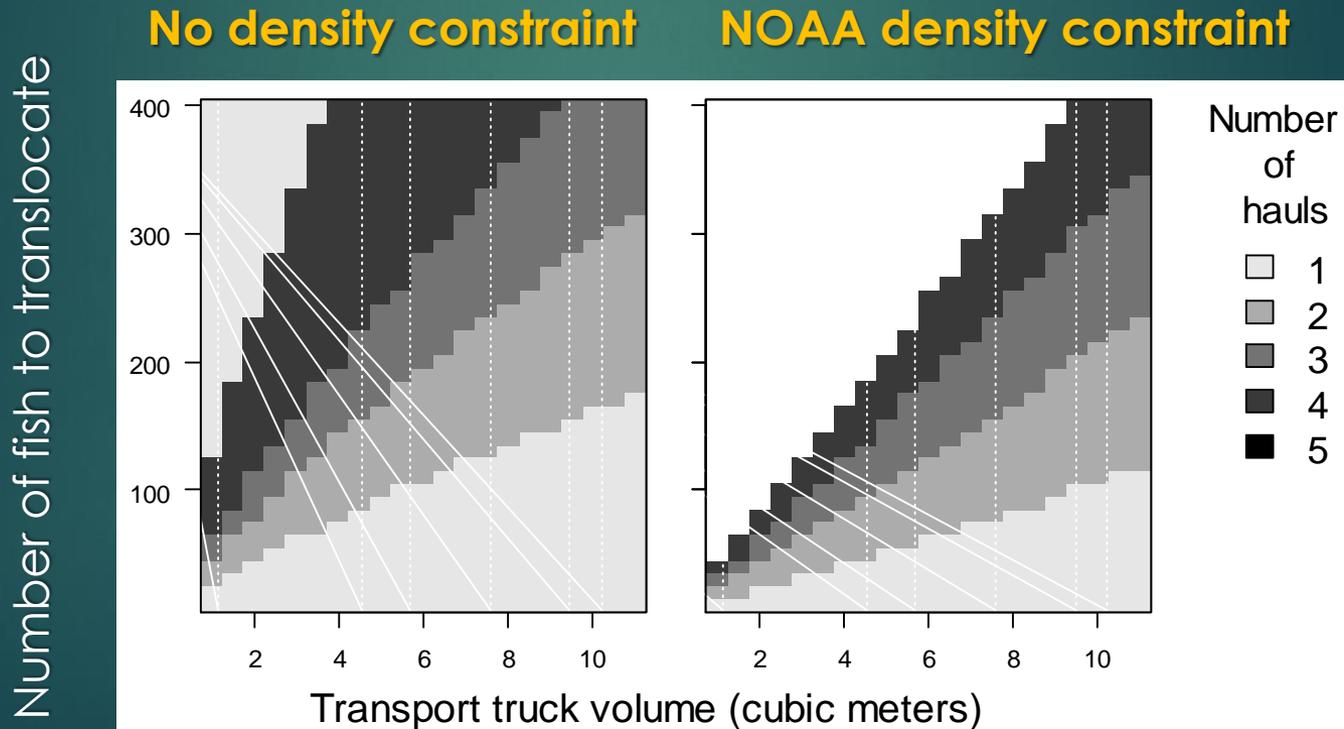


Unexplained variation

Another big unknown: what do managers do about PSM?

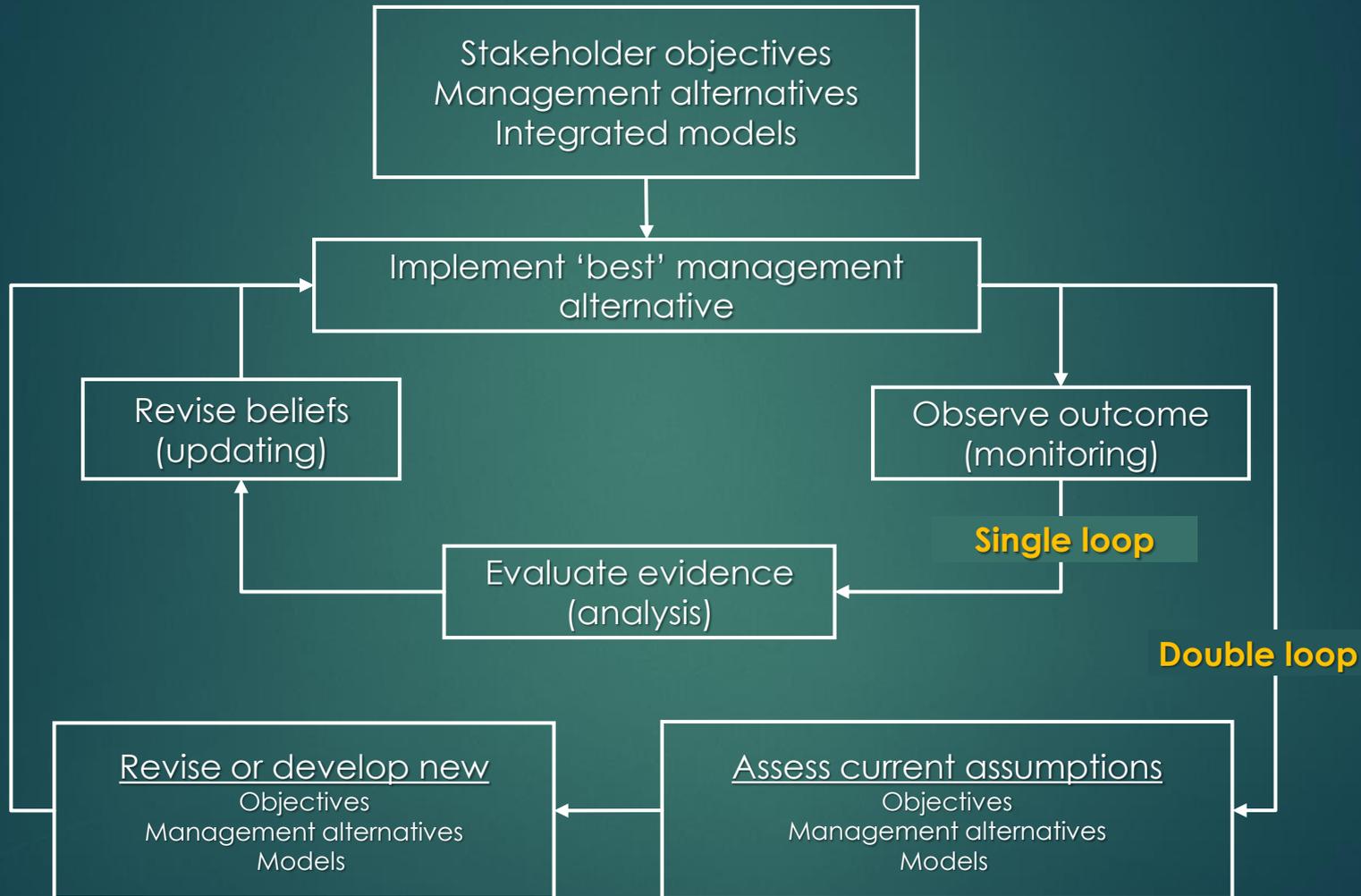
Example of decision tool:

outplanting guidelines to minimize mortality (Colvin et al.)



What if uncertainties/gaps remain after study?

Adaptive management and single and double loop learning



Goals and Objectives

Willamette Chinook recovery plan a strategy.
What's needed are development of tactics.

Goal: Use outplanting to develop sustainable wild runs

Needed: a reintroduction plan and operational guidelines

1. Develop tactics to ensure spawner success
 - a. Minimize PSM
 - b. Minimize negative sublethal effects
2. Develop decision tools for managers that minimize PSM (transport and outplant) and negative sublethal effects
- * 3. Ideally integrate decision tools with monitoring = adaptive management

Proposed Approach PSM

Implement experimental approach

Incomplete block design (ensure sufficient replicates)

Factors to evaluate

facility Arrival of adults to (early, late)

Holding time at facility (short, long)

Trap operation (closed short, long periods)

Fish sedation and handling events (Single event, Multiple short events)

Anesthetics used to sedate fish for processing (Eugenol, CO₂)

Density of fish in transport tank (Low/high density)

Time of day for outplanting (Early, late)

Driving distance to outplant location (Short, Long)

Condition of outplant location

Proposed Approach PSM

Randomly assign treatments

Pit-tag

Ancillary data

stream temps, E-DNA from tanks/ stream

Crews search for PSM daily from initial outplanting

greater effort = higher detections (↑ data quality)

greater chance finding fresh /nearly dead

Analyses and modeling

Decision model development (for use in all tribs.)

- sensitivity analysis (identify remaining key uncertainties)
- integrate w/ effectiveness monitoring (reduce uncertainties)
- Ideally, key part to a reintroduction plan

Proposed Approach Sublethal Effects

Two approaches:

Field based

- pair with PSM study
- Genetic samples outplants
- Pedigree analysis

Hatchery

- Early, mid, late fish
- Genetic samples
- Hold and spawn
- Gamete/embryo performance

Incorporate into reintroduction plan